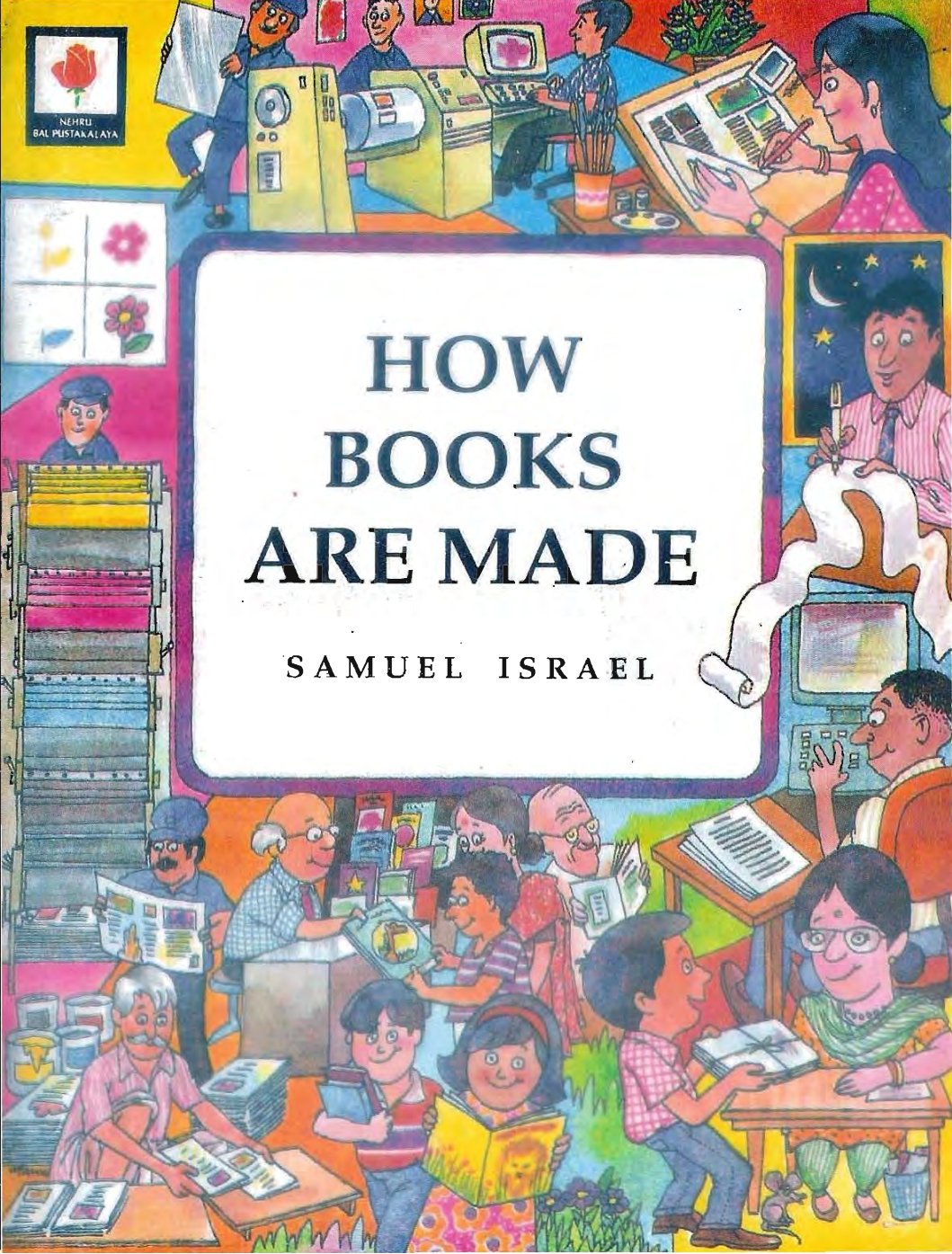




HOW BOOKS ARE MADE

SAMUEL ISRAEL



Nehru Bal Pustakalaya

HOW BOOKS ARE MADE

SAMUEL ISRAEL



NATIONAL BOOK TRUST, INDIA

ACKNOWLEDGMENTS

Thanks are due to the following individuals and organizations for the illustrations listed against their names: Dr Kapila Vatsyayan (p.9); Archaeological Survey of India (pp. 11, 14 - top); National Museum (pp. 13, 14 - bottom, 18 -bottom, 23 -left); *UNESCO Courier* (pp. 12, 20-21, 24, 27); Indraprastha Press, New Delhi (pp. 28, 30 - left, 42). Illustrations on pages 34 and 55 are based on references made available by Indopolygraph Pvt. Ltd., New Delhi; those on pages 60 and 61 are drawn from promotional material issued by Oxford University Press, New Delhi; and the sketches on pages 62 and 64 are based on information drawn from the illustrated article, 'The Electronic Book,' by Michael Rogers reprinted by the US Information Agency magazine *Span* (March 1944). These last and other illustrations have been executed by National Book Trust staff artists and photographers.

S.I.

First published under the title
The Wonderful World of Books, 1980

ISBN 81-237-2470-5

First Edition 1980

First Reprint 1988

Second Edition (revised and updated) 1998

First Reprint 1999 (*Saka 1921*)

© Samuel Israel, 1980, 1998

Published by the Director, National Book Trust, India
A-5 Green Park, New Delhi-110 016

This revised edition is for
RACHAEL RUKMINI
and
RAPHAEL RAHUL

CONTENTS

Books	5
Speaking Books	7
Written Books	10
Parchment and Papyrus	16
Paper	20
Printing	23
Printing Machines	29
Phototypesetting	35
Making a Book	40
Illustrations	51
Authors, Publishers and Copyright	56
The Future of the Book and the Book of the Future	60

BOOKS

Books are of many kinds—exercise books for doing homework in, copybooks, drawing books, textbooks, picture books, diaries, notebooks, account books, painting books, story books, ‘comics’: books on every possible subject—history, geography, maths, physics, chemistry, space travel, computers, exploration, nature, astronomy, cooking, football, cricket, mountaineering; there is no end to what books can be about. You can even have books about books, like this one.



Some atlases are very large.

Your dictionary is a big book, probably with stiff board covers covered with cloth; the 'comic' you borrowed from a friend has a smooth and shiny paper cover; your history text perhaps has a cover made of card; some books are sewn with thread; some, like this book, are stitched with wire staples through the back.

You need only look at a collection of books to get an idea of what things go into their making: paper, board, card, ink and, if you look a little more closely, gum and thread. All this is, of course, put together by skilled workmen, either by hand or with the help of machines. This is done at printing presses and binderies (factories where printed sheets of paper are put together and secured, or bound, in proper order and supplied with a cover).

But leaving aside objects like exercise and drawing books, the starting point of a book is not a *thing* but an *idea* or strong *feeling* in the head and heart of an author or artist, or both in partnership.



SPEAKING BOOKS

How do people come to write books? Most often because they believe they have something interesting and important to say or a good story to tell or an interesting experience to relate. Whether the rest of the world agrees or not, they believe that what they have to say or tell should not be lost with them, and that many more people



The oral tradition in India is an ancient one.

than those around them should have an opportunity to share the profit and pleasure their words could bring.

Six or seven thousand years ago, people who felt the 'urge to communicate' had no means other than their tongues to do so. Writing had not developed, or was at a very rudimentary stage. Great thinkers, teachers and story-tellers would wander from place to place, speaking their thoughts or telling their tales; or people would come to them and listen. Devoted disciples would learn their masters' words by heart and then spread them to far-off places. Often these lessons would be taught or the stories told in long poems, now called epics. This not only made them easier to remember but also much more pleasant to listen to.

This is the way our Vedas, Mahabharat, Ramayan, and much else of our ancient literature, were preserved and passed on, from generation to generation, for hundreds of years, before they came to be written down. This is how the teachings of Gautam Buddha and Mahavir were spread all over India and also to distant countries in east and central Asia.

This way of 'spreading the word' continues to be practised in our country to this day, especially in rural areas. The Ramayan, the Gita and stories from the Mahabharat are recited by wandering minstrels all over the country. We still have wandering story-tellers. In fact, even today there are groups of people in our country, and elsewhere in Asia and in Africa, who do not depend on writing (who, indeed, have no scripts to write in) to

preserve their wisdom, their ideas, their culture, their laws, their customs, their beliefs and their legends. They depend on what is called an 'oral tradition' to preserve what their ancestors have handed down to them. But things are changing fast.



We still have our wandering minstrels.

WRITTEN BOOKS

When scripts (writing) developed, it became much easier to spread the word. What people had to say or tell could be written down either by these persons themselves or by others. In this way, it was preserved for the future and passed on for reading from person to person, or from place to place. The problem now was that there were not enough things one could conveniently write on and pass from hand to hand. In most parts of the world, the process of paper-making was then unknown.

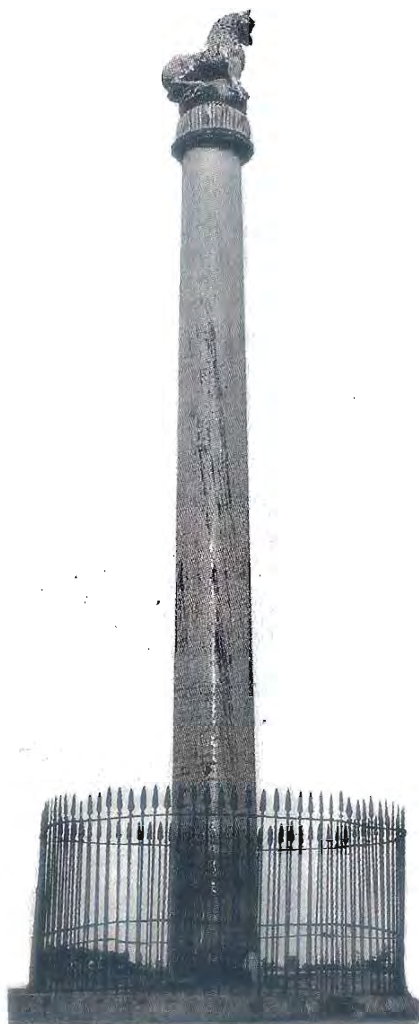
What was once written, could be copied again and again. An early example of the same writing spread over many parts of India is the famous edicts of Ashoka which were inscribed (cut or carved) on rocks or stone pillars in a number of places.

Copper, the earliest metal man put to use for making tools, weapons, jewellery and household utensils in the prehistoric Copper Age, found additional use in early historical times. Inscriptions on plates of this metal, held together by rings, very much like modern spiral-bound books, were used for preserving important records and documents.

But stone and metal are not very convenient to write on. Stone carving and metal engraving can be done by people with special skills. Ink or paint does not stand out on these materials and is soon washed or rubbed away.

Tablets of soft clay were much easier to write on with a pointed rod called a *stylus*. After being written on, the clay was baked hard in an oven, making the writing permanent. Whole books were written and preserved in this way. In the valley between the Tigris and Euphrates rivers in Iraq, a library of some 30,000 tablets was discovered, each book consisting of a series of numbered tablets, like the numbered pages of a book. This library was set up by a king called Ashurbanipal who ruled in the area two thousand five hundred years ago.

But clay tablets are not convenient to handle, whether for the writer or the reader. In India, this difficulty was overcome by writing on leaves, on the bark of certain trees, on animal skins and on cloth.



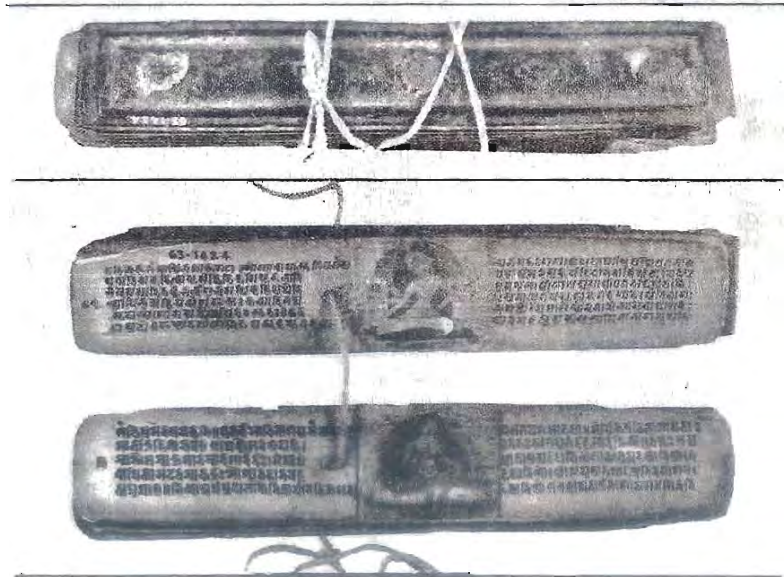
One of Ashoka's pillars. The inscription is on the lower third, partly obscured by the recently added railing.



An inscribed clay tablet from ancient Iraq, dating from about 2000 BC.

The last was not very convenient as ink spreads on cloth unless it is the kind that dries very quickly.

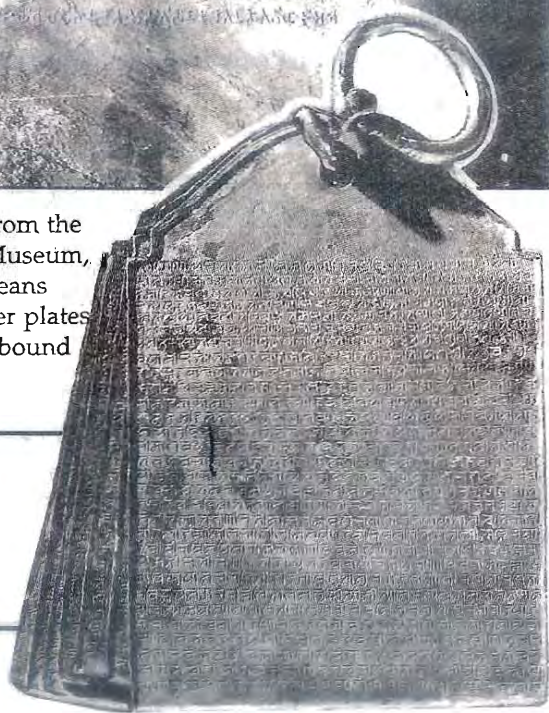
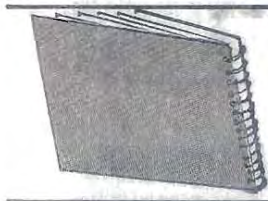
Most common in India, before paper became widely available, was the use of dried palm leaf for writing and making copies of books. Even four or five hundred years ago, when paper had become available, palm leaf copies of books were still being made. A number of examples are preserved in our museums and libraries, and even in private collections.



A palm leaf manuscript book from the collection of the National Museum, Delhi. The lower picture shows the book open for reading. Notice the method used for 'binding' and how the book is closed and secured, as shown in the upper picture.



Copper plate inscriptions from the collection of the National Museum, Delhi. Notice the similar means adopted to 'bind' the copper plates and the pages of the spiral-bound book which is also shown.



Opposite : Adult education not only spreads literacy but also helps ensure that children grow up literate and educated.

With palm leaf books, writing could be both preserved and made available to many more people than ever before. But the circle was still a small one. Each additional copy had to be written laboriously by hand and books continued to be rare and expensive. Even when paper became widely available, the difficulty of making copies by hand remained and books were still few and costly.

When books are difficult to get, being able to read, literacy, is for many people, not very important. The opportunities to read are so rare that people do not feel the need for this skill. If they do acquire it, they often lose it for want of practice. Such people continue to depend on oral, word of mouth, transmission (spreading or passing on) of their knowledge and wisdom. Progress, under such circumstances, is very slow.

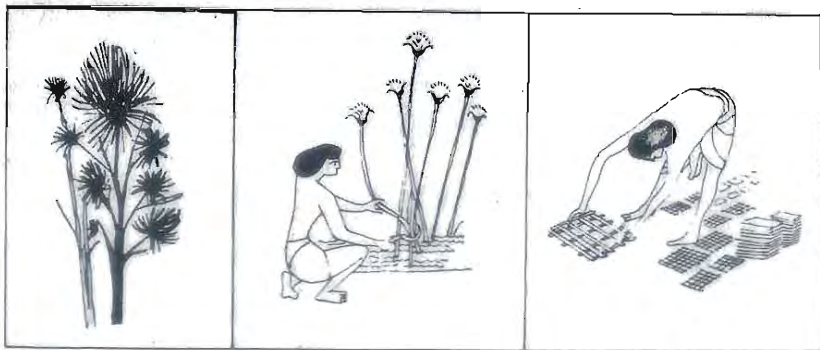


PARCHMENT AND PAPYRUS

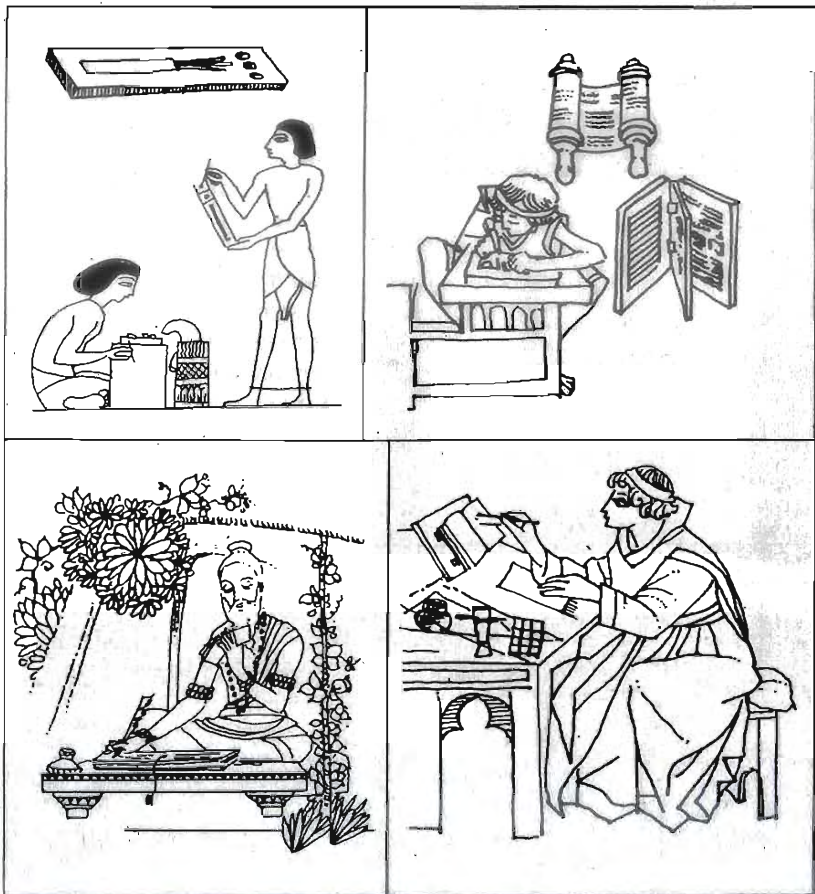
Even as long as five or six thousand years ago, the Egyptians had discovered a way of making paper from the stalks of a tall reed that grew in the marshes on the banks of the river Nile. The reed was called *papyrus* and it is from this that the English word *paper* has come.

To make papyrus, as the sheets of writing material also came to be called, the stalks were split into long strips with the help of a sharp needle. These strips were laid side by side on a stone slab and a gummy solution was spread over them. Another layer of strips was then laid across the first set and the two layers were pressed together and dried to form sheets which were rubbed smooth with stone, shell or bone.

Papyrus used to be exported from ancient Egypt to Mediterranean countries and also to more distant lands.



Papyrus manufacture in ancient Egypt.



Making handwritten copies of books.

Top left : In ancient Egypt, papyrus was the writing material.

Top right : A slave in ancient Greece or Rome might have looked like this while taking dictation to make a copy of a book.

Also shown are a scroll and a wax book.

Bottom left : In India, palm leaf was often used.

Bottom right : In Europe, before the advent of printing, monks belonging to religious orders were among the most active in making copies of books.



Left : A contemporary parchment scroll from a Delhi synagogue (a place of Jewish worship). The text, in the classical Hebrew language, is a manuscript copy of the Books of the Law from the Bible.

Below : This 'illuminated' (decorated with coloured designs and illustrations) Persian language manuscript version of the Ramayan is said to have been prepared at the command of a Mughal emperor.



But supplies were limited and there were occasions when exports were banned. The chief substitute that was developed in Europe and the Arab world was *parchment*. This was animal skin specially treated to make it suitable for writing on.

Parchment is very long-lasting, and ancient scrolls made of this material have survived a thousand years and more. Fragments of scrolls with parts of the Bible written on them in the ancient Hebrew language (the sacred language of the Jews) were discovered in 1947 in a cave on the banks of the Dead Sea in Israel. These fragments of parchment, archaeologists believe, have survived some two thousand years. They are still largely legible.

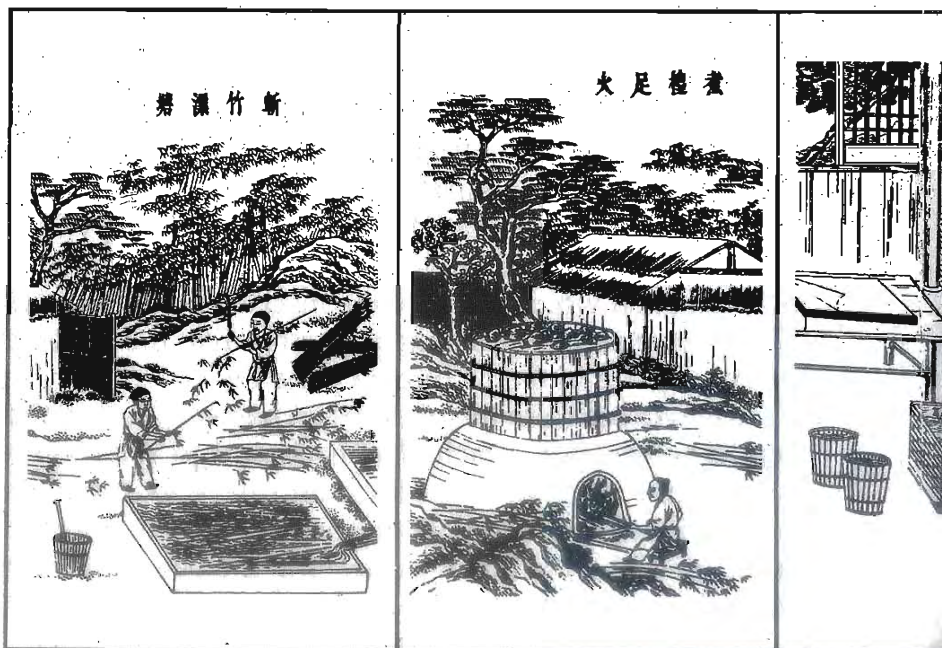
The books of ancient Greece and Rome were mostly scrolls of papyrus or parchment. Many copies of books were made simultaneously by dictating from the original books to a team of educated slaves who would copy them as do students in a 'dictation' exercise. Wax tablets were also used, on which letters were inscribed with a stylus. These were sometimes joined together like the pages of books, as seen in the picture on page 17.

You will see from the pictures on pages 17 and 18 that scrolls were often attached at each end to rods round which they were wound. You don't have to 'turn' the pages of such books as you read on; you have to roll them from one rod on to the other, leaving the page you want to read open in between.

PAPER

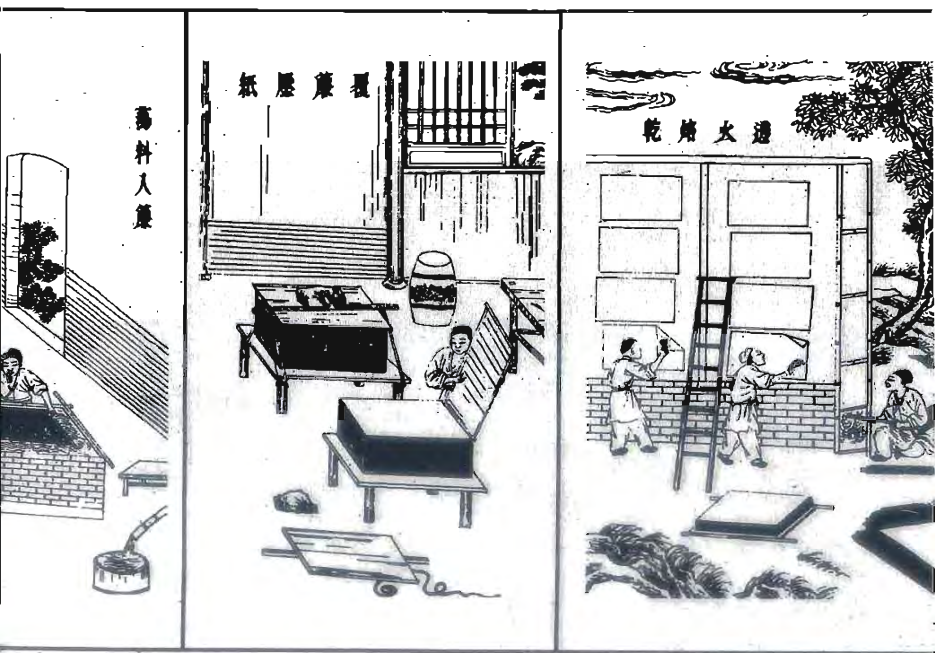
It was the invention of paper and printing that ultimately gave us books as we now know them. Both of these were known to our neighbours, the Chinese, more than two thousand years ago.

Ancient Chinese paper was essentially what paper is today: sheets of dried and smoothened wood- and/or rag-pulp. Straw and bamboo are also sources of pulp for paper-making.



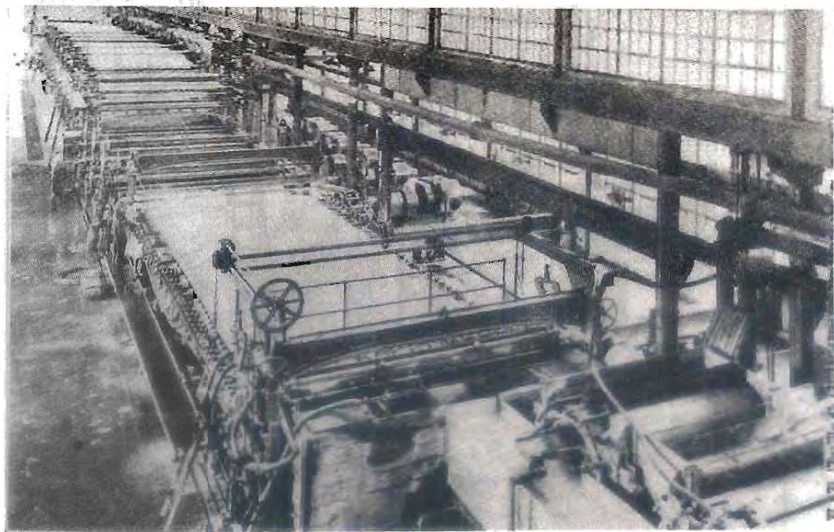
These panels show five stages in the ancient process of Chinese

The raw material is soaked in water and pulped either by mechanical pounding or chemical treatment, or a combination of the two. The ancient Chinese did the job mechanically. The pounding and the chemical treatment separate the wood or cotton fibres and break them into short lengths. A large tray with a bottom made of fine cloth is dipped into the pulp. As it is lifted out, water drains off, leaving behind an even layer of pulp on the cloth bottom. The layer is pressed and dried to form a sheet of paper.



paper-making, as illustrated in a Chinese book printed in AD 1637.

The art of paper-making is believed to have already spread to India by the seventh century after Christ. It spread further westward only in the eighth century. Expert Chinese paper - makers were captured by Arab invaders at Samarkand (briefly capital city of Uzbekistan) in Central Asia. Through them, the art was spread to the Arab countries and the Arabs carried the industry to Europe in the late twelfth century. Once established in Europe, the industry developed steadily. Like other industries there, the paper industry was rapidly mechanized in the eighteenth and nineteenth centuries. The industrial revolution resulted in an enormous, and ever increasing, demand for paper.



An Indian paper mill.

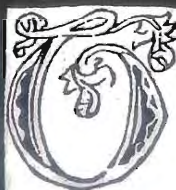
PRINTING

Hand printing from seals and blocks (very much as sari designs are even today printed from carved wooden blocks) is an ancient art. A skilled wood-carver, who can make blocks for intricate sari designs printed in two or three colours, can certainly carve blocks for whole pages of pictures and writing. But it has to be mirror writing if it is to be read the right way when printed, just as with a rubber stamp. The Chinese had been printing books by this method some eighteen hundred years ago and block printing of illustrations and short texts was done elsewhere also, but much later on.

It is not surprising that very few books could be printed



Left : One of the many seals discovered at Mohenjo Daro, one of the major sites of the ancient (about 2000 BC) Indus Valley civilization.
Right : A carved wooden block and a print from it.



Redimuntur Capitulum.
loquitur ihesus parabolas
de senectute et senectute
Quartum decimum caput
tulum. De iohannis decollatione
Et refectio ex quinque panibus
Quintum decimum caput
tulum. De non lotis manibus et de mudi
ere chanaana cuius filiam cecus
lauavit. Sextum. Capitu
lum. De signo iohannis prophete et
de responsione petri et Tu es
petrus et super hanc petram edific
abo ecclesiam meam. Decimum
septimum. Capitulum. Assup
sit ihesus petrum iacobum et jo
hannem et. Et coram ipsis tras
figuratus es. Decimum octauum
capitulum. De puero quem staphan
us in medio et et dos dimittit septu
ages

An example of printing whole pages from wooden blocks. This page is reproduced from a book printed in Germany around AD 1470.

by this method and people preferred to copy books by hand as long as printing a book involved carving all of it on hundreds of blocks of wood at great expense of time and money. Also, carving letters in small sizes on wood is extremely difficult. Carving them in large sizes would mean carving many more blocks. Also a book with few words per line and few lines per page is tiresome to read.

The idea that made all the difference was that, instead of carving whole pages, one could carve individual letters (type) and then put them together in the right order, with spaces and punctuation marks, to form words and lines and pages. This is the process a printer today calls *composing*. The composed type can be dispersed after printing and re-composed to print other books, again and again, till it is worn out. Today, this sounds simple enough, but many difficulties had to be overcome, and many problems solved, before the idea could be put into practice.

A little earlier it was mentioned that it is very difficult to carve letters in small sizes even on whole blocks of wood. How much more difficult it would be to carve them at the ends of little wooden sticks; and how many of each letter one would need to set up even a single page! Count the c's and s's on this page and you will get an idea.

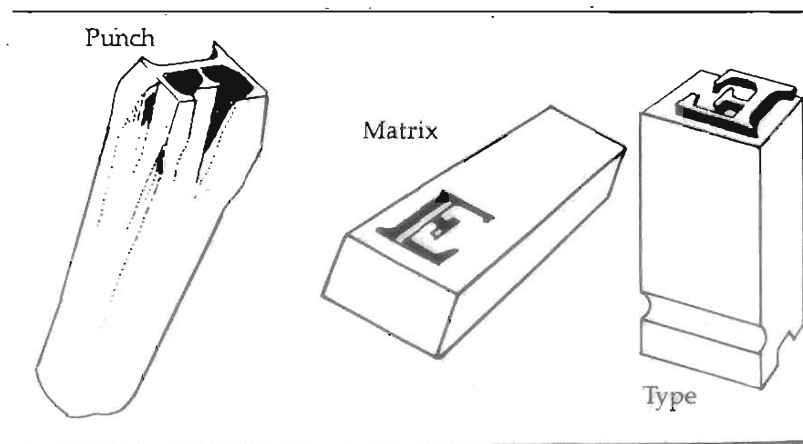
In spite of these difficulties, the ingenious Chinese, even a thousand years ago, made and used movable type of baked clay and, later, even of wood, bronze and tin; but their use was only occasional and must have presented many problems since the main trend in printing in ancient China continued to be based on wooden blocks.

Movable Metal Type

It was the genius of a German named Johann Gutenberg, combined with the advance of the science and art of working metals (metallurgy) that solved the problem round about the year AD 1450.

What Gutenberg did was to cut a mirror image of each letter at the end of a stick of hard steel. This is called a *punch*. Each punch was placed over a flat strip of copper or brass and struck sharply with a heavy hammer to impress the image of the letter on the strip which is called a *matrix*. The matrix was fitted to a *mould* into which molten lead was poured. The lead cooled and formed a piece of solid *type*, again in mirror image.

You will see that, from a single mould, large quantities of type can be cast; and that, once one has a matrix; one can make a number of moulds and make them available





Stamp issued in Germany in 1956 to commemorate the 500th anniversary of the printing of Gutenberg's edition of the Bible, believed to be the first ever book to be printed from movable metal type outside ancient China.

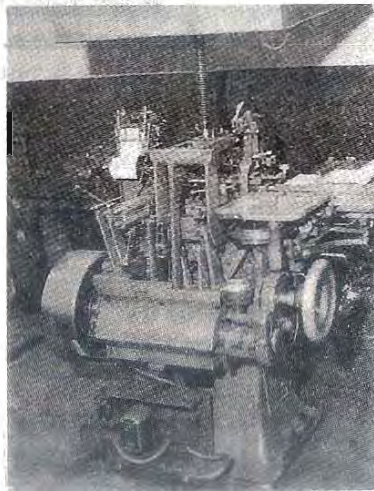
to a number of people. Metal type can be *composed* into words and lines, *made up* into pages, printed, and then dispersed and used again and again till it wears out. Worn out type can be melted and re-moulded.

Mechanical Typesetting

Type composition was originally done only manually, by *compositors* who picked out individual pieces of type from a tray carrying multiple pieces of each character, arranging them letter by letter and word by word into lines and pages. With the advent of Linotype and Monotype machines at the end of the nineteenth century and early in the twentieth, the process was automated. These

machines have keyboards like typewriters (with extra keys for feeding in typographical instructions). The text is 'typed' in, and letters, words and lines get automatically cast from molten metal.

However, hand-composition continued to be widely used in India till the nineteen-eighties, especially for Indian languages. It is only now on its way out, with the advent of computer-assisted typesetting which will be briefly described after we have said something about two major printing processes and particularly about *offset printing*, for which computer-assisted typesetting is so well suited.



Left : A photograph of a Linotype typesetting machine. *Right* : A Monotype caster that casts individual metal types, arranged in words and lines as instructed by a code of perforated holes in a continuous roll of paper, the perforation pattern being governed by a separate keyboard unit. In the Linotype, keyboarding and casting are combined in a single unit, which sets the type in solid slugs in units of lines. These are both heavy machines and consumers of substantial quantities of electric power.

PRINTING MACHINES

Letterpress Printing

To print composed matter, Gutenberg fixed it firmly in a frame (to prevent the type falling apart and getting mixed) and laid it on the bed of a *press*. The surface of the type was inked and a sheet of paper carefully placed in position over it. The sheet was then evenly pressed over the type by a simple hand-powered machine. After the pressure was released, the sheet was lifted off and put aside to dry. The operation was repeated with the next sheet, and so on till the required number of copies had been printed.

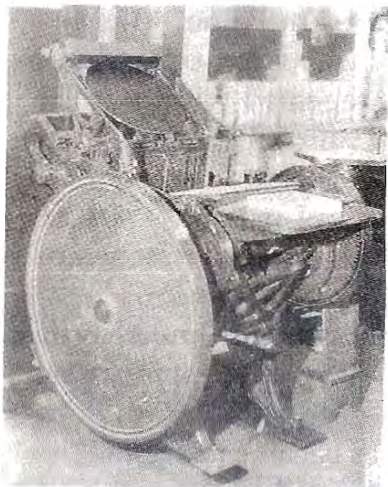
Now we know why we speak of printing *presses*. Pressing paper on inked type is the essential function of a printing machine.

Since Gutenberg's time, printing from metal type (*letterpress* printing, as it is called) developed rapidly. One by one, hand operations were eliminated from both composing and printing. Machines became faster and the quality of printing steadily improved with improved machinery. Machines also became larger and today there are large and complex units that carry out multiple operations. For example, paper is fed in from huge rolls at one end and finished paperback books come out at the other, without any human intervention, once the plates of the composed matter have been fitted in and the machine properly set.

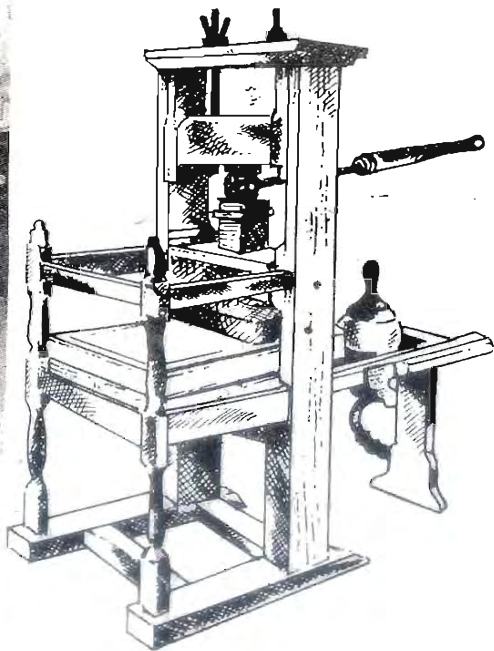
Offset Printing

To catch up with today, however, we shall for a while have to go back to 1798, some three and a half centuries after Gutenberg, which saw the beginnings, again in Germany, of a printing process that had eliminated the need for metal type altogether.

Strangely enough, the initial invention was by a writer, a dramatist, Aloys Senefelder, who was looking for a way of making copies of his plays without the expense of



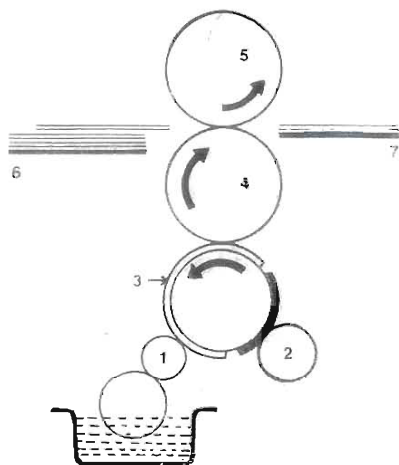
Small printing machines like this one, often more than 75 years old, are still doing useful work in hundreds of presses all over India. They are often called 'treadles' because they used to be powered by a foot pedal. Today, most of them run on electric motors.



The kind of press used in Gutenberg's time.

The principle of the offset printing machine.

Roller (1) picks up a layer of moisture from the lower roller that rotates in a water-bath. Roller (2) carries oil-based ink and comes in contact with roller (3) only when it has to ink the plate shown in black round part of it, and only *after* it has been dampened by roller (1). As the rollers rotate in the directions shown by the arrows, the plate transfers the image to the rubber surface of roller (4) from which it is transferred (offset) to paper under pressure from roller (5). Blank paper is fed in at (6) and printed paper is delivered at (7). The actual mechanisms are, of course, much more complicated.



having them set in type and printed. Senefelder marked the surface of a slab of limestone with greasy crayons and oil-based inks such as letterpress printers used, and found, when he wet the marked surface, that only the blank, unmarked parts of it got wet since oil repels water. When, in turn, oil-based ink was spread on the surface, it was repelled by the wet, unmarked portions of the surface and absorbed only by the marked, oily portions. Then, by pressing a sheet on the moist/inked surface, an image of the markings was transferred to (printed on) the sheet. Since the surface from which the sheets are printed is virtually flat, the process is described as *planographic*, as against letterpress printing which is a relief process, since the face of metal type is raised (in relief) over a base

(see illustration on page 26). Because it utilized a surface of treated stone, the process was called *lithography* (Greek *lithos*-stone, *graphe*-writing).

In lithography, matter can of course be written or drawn direct on the stone surface, but it would have to be in mirror-image form if the prints are to read correctly. With the use of special inks and paper, however, means were devised to transfer a mirror-image to the stone after writing or drawing it in the normal way.

Lithography proved particularly useful for printing in languages with scripts like Urdu and Persian which do not conveniently lend themselves to composition in metal type. Types in the scripts of such languages were cast in India but were neither popular with readers and scholars nor with printers. Even today in India, Urdu printing is widely done from text handwritten by *khatibs*, expert calligraphers, some of whom are noted for their artistry.

While artists making 'lithographs' still take copies of their works patiently, one by one; carefully, colour by colour, from the flat lithographic surface, commercial lithographic printing was increasingly mechanized and improved steadily in quality and speed. The use of metal sheets (mostly of aluminium) instead of stone slabs makes it possible to wrap them round cylindrical rollers, which helped greatly in speeding up the printing process. Later, improved results were obtained by transferring (*offsetting*) the inked image to an additional rubber-covered roller from which the image was impressed on the paper, rather than direct from the plate. Hence the current term, *offset printing*.

If the surface of an offset plate is photo-sensitized, images can be transferred to it. This involves photographing the image to be transferred and then again photographically transferring it to the plate. Hence the term *photo-offset* printing. So, if we want to print a *new* book by the photo-offset process, we will, in any case, have to set it in type first, then prepare prints of the pages and then photograph them for transfer to offset plates.

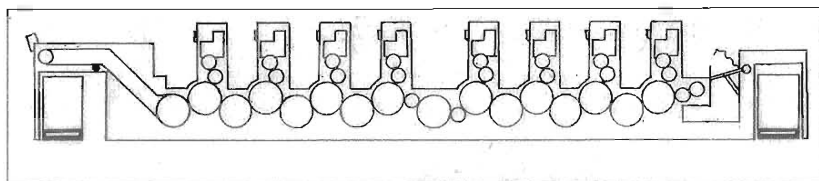
But, if we have already had a book typeset in pages, why just print a single copy for offset reproduction? Why not print all the copies we require by the letterpress process? This is, in fact, what was mostly done. The photo-



A contemporary *khatib* at work. Computer-assisted typesetting has now entered his field also.

offset process was most useful when a book had to be rapidly reprinted as the pages of the first printing could be photographically transferred to offset plates, saving the considerable labour, time, trouble and cost involved in setting the book in type afresh. Storing film is much easier than keeping tons of composed metal type stacked. The photo-offset process is also more suitable than letterpress when a very large number of copies have to be printed as offset printing machines run at great speeds. Also type wears out in the course of printing much more quickly than offset plates do.

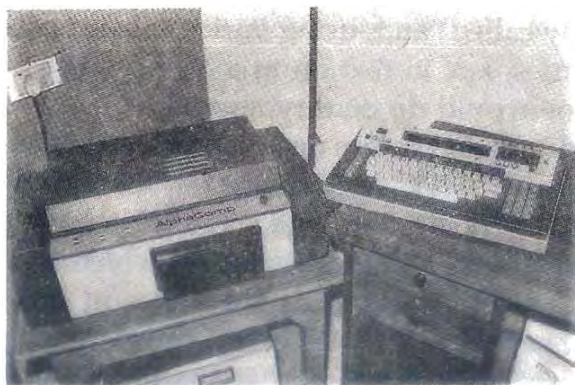
It is only in our own times that photo-offset printing is rapidly displacing letterpress printing. The process began with the advent of the phototypesetter and is now reaching its climax with the advent and rapid progress of computer-assisted typesetting, which eliminates metal type altogether. To these developments we must now turn.



This is a diagrammatic representation of a multiple-station offset printing machine (compare with illustration on page 31. For a photographic representation, see page 55. Since there are eight stages, the machine could print four colours in succession on the two sides of a sheet (see pages 53-55.

PHOTOTYPESETTING

The phototypesetter became available in India in the 1960's. Because of its high cost it had limited application in the setting of type for books. Also, while costing more than the current Linotype and Monotype setting, like them it presented difficulties in carrying out corrections and making changes in matter once initially set. The first phototypesetters used a combined electromechanical and optical technique to set lines of type in the form of images on light-sensitive film (that is why they were sometimes called film-setters). Modern phototypesetters use electronic, electromechanical and optical processes rather than just the latter two.



A phototypesetting unit which yields setting in the form of photographic negatives or positives on film in 'galley' lengths or made up into pages as it might be instructed either through a keyboard or a disc on which the necessary instructions have been digitally recorded on a computer.

A full-scale 'dedicated' computerized phototypesetter, that is one that has been designed expressly for phototypesetting and which can supply typeset material as sharp black on white images on glossy photographic paper, is still a very expensive proposition. But, fortunately, those companies that possess them are usually willing to sell services on them.

What really made photosetting a practical and economic process for the average Indian printer/publisher was the spectacular and currently ongoing progress in computer technology over the last twenty years. Thanks to the ever-growing capacity of the microchip to store and process information, there has been a sharp fall in the size and cost of computers. Even a small-scale investor can now afford to buy a 'personal computer' (a PC as it is commonly called) and, using various 'word processing' programmes, key in text on to a 'floppy disc', more or less as one would do on a typewriter.

A medium-sized office desk can accommodate current models of PCs. A PC comprises a keyboard that controls and instructs the data storage and a processing unit (the computer proper), a display screen (on which matter being keyed in can be read and checked and corrected if necessary before further matter is keyed in), and a 'printer' that can record it on paper, when required. Since the text is initially recorded on a disc inserted in (and removable from) the processing unit, corrections and changes, including additions and deletions, can be done at later



A DTP unit. To the left of the screen is the computer unit; to its right is a stand for the 'copy' to be typeset; next to it is a laser printer with two 'floppy discs' lying in front of it. (What one sees is of course the sleeve in which the discs are contained, not discs themselves.) It is on such discs that the computer unit records the coded instructions fed to it via the keyboard. These instructions are decoded by the laser printer to provide prints on paper which could serve as camera-ready copy (CRC) for offset camera. Contrast this with the bulky, expensive units of machinery used for setting type in metal (see illustrations on page 28)

stages also with comparative ease. All the shifting and rearrangement of words and lines necessary is done literally in the twinkling of an eye by the computer. Instructing it on what has to be done is, of course, a manual process which takes much much longer but nowhere near as long as it would take to carry out the same changes in matter set in metal type. In the case of computerized word processing, the job can be done by the author/editor himself. This on-machine editing facility was not available with Linotype and Monotype composition.

While the prints one gets from the printer attached to a PC are adequate for checking, correction, communication and documentation, they are not in a form or of a quality suitable for regular printing. To get typeset matter in a form suitable for being photographed (camera-ready as it is termed) for transfer to offset plates, a dedicated computerized phototypesetter is needed. The disc on which the text and typographical instructions have been recorded are fed into this typesetter which reproduces the coded material, in the typeface and arrangement required, as sharp black-and-white images on photosensitized paper.

A less expensive typesetting device, which supplies fairly sharp images of typeset matter from a computer disc is the *laser printer*. It can print on plain paper. Though the quality of the images is inferior to that from a photosetter, it is good enough for many purposes and is often used for books when it is necessary to control costs. Laser printers too are being steadily refined and recent models are said to be capable of almost matching photoset material in sharpness and quality.

It is this combination of PC with laser printer that makes what is called *Desk Top Publishing* (DTP) possible. Laser prints of all the pages constituting a book can be copied in the quantity required on a xerographic machine and put together in sets to constitute copies of the publication. The whole operation from manuscript to book having been accomplished on equipment accommodated on office tables, calling it DTP is appropriate. (If a large number of copies are required, it would be more economical to print by the photo-offset process, as a regular publisher would.)

Since photsetter/laser printer output is either on film or paper, only photo-offset printing can reproduce it.

With the ownership of personal computers becoming increasingly widespread both by business organizations and institutions, and even by individuals, it is now possible for authors, using a suitable word-processing programme, to submit their 'manuscripts' to publishers recorded on 'floppy 'discs'. The editor can edit the manuscripts available on the disc on her PC before passing it on to the typesetter. Thus, the typesetter does not have to key in the text from a typescript or manuscript, but simply uses the disc on which the edited text has been recorded. The author and/or publisher can therefore now undertake a major part of the typesetting operation, which previously lay entirely in the domain of the typesetter or printer.

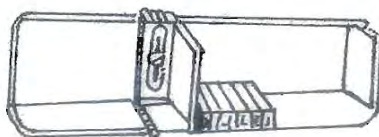
Thus, even if the publisher has to pay for photsetter output from his discs, he saves considerably on composition which is an extremely expensive item in letterpress typesetting.

MAKING A BOOK

Editors

Publishers employ editors to advise them on which books to accept for publication and also to help them get the right books written for them by the right authors. The two things a publisher keeps in mind when deciding whether or not he should publish a book are whether the book is a good one of its kind and whether he can expect to sell all, or at least most, of the copies printed fairly soon.

The editor's next job is to prepare the author's manuscript (abbreviated MS; plural MSS) for press. He will carefully read through the whole of it, keeping in mind the kind of reader for whom the book is meant. If he thinks this necessary, he will suggest changes to the author that will make the book more readable and clear. These may include suggestions that some parts may be

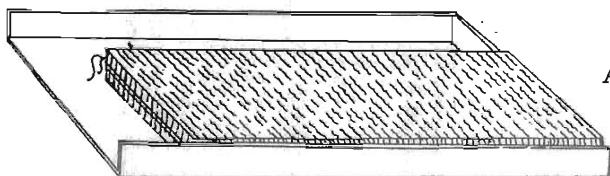


A composing stick used in hand composition to assemble lines of metal type, one above the other. Every four or five lines composed are transferred to a galley tray as shown in the next picture. These items of the traditional compositor's equipment are becoming increasingly obsolete with the advent of computer-assisted type composition and the diminishing use of metal type.

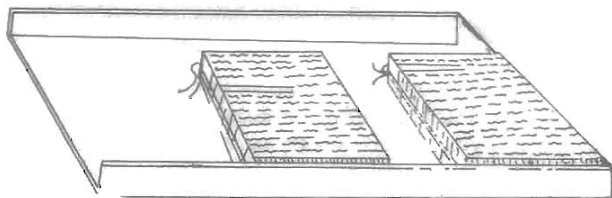
omitted or some matter added, or some portions shortened. Either while this is being done, or in a second operation that follows it, the MS is checked in detail for spelling, grammar, uniformity and completeness, among other things. Instructions to the printer about the way the text has to be set in type are also 'marked up' on the MS. This second job is called *copy-editing*, 'copy' being the term printers use for MSS and other matter given to them for setting in type.

Composition and Proofs

The publisher's production section now takes charge and passes on the MS for typesetting, giving full instructions concerning the general design of the book, the typesetting and printing process to be adopted, the typeface wanted,



A galley tray

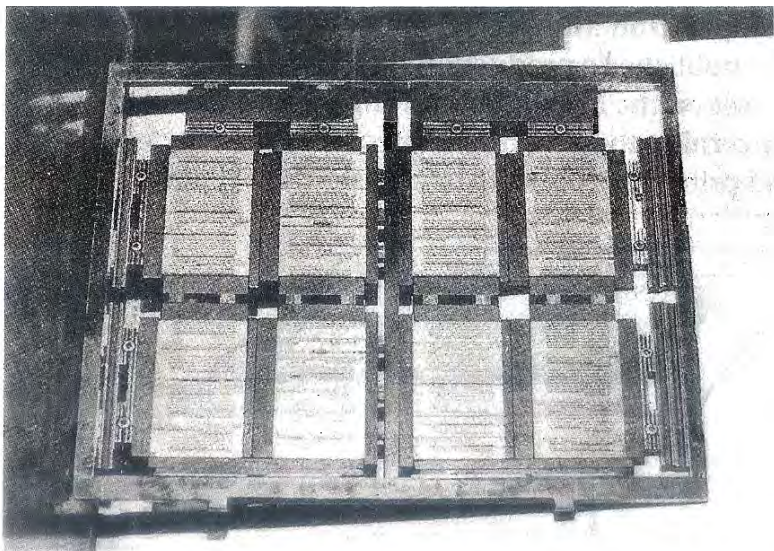


Galleys broken up into pages

the way the pages have to be 'laid-out', and a number of other matters.

Matter set in metal type is stored in long trays (called *galleys*), or, in the case of photosetting, as photographic prints on lengths of glossy paper or transparent film in negative or positive form.

Rough prints of setting in metal type are made on simple machines (usually hand-powered) or by photocopying in the case of photosetting. These prints



An eight-page *forme* locked up for letterpress (from metal type) printing. Notice the metal *furniture* combined with the wood. A key fits into the circular eyes which, when turned, tightens or loosens the metal furniture. Computer-assisted typesetting and offset printing is now eliminating the necessity of handling such extremely heavy frames. Even large offset plates are extremely light and are thin and flexible enough to wrap around the roller of offset printing machines.

called *proofs* are sent to the author and editor for correction of typesetting errors. *Proofs* is the term used for prints of set matter made in limited numbers only for purposes of checking the set matter.

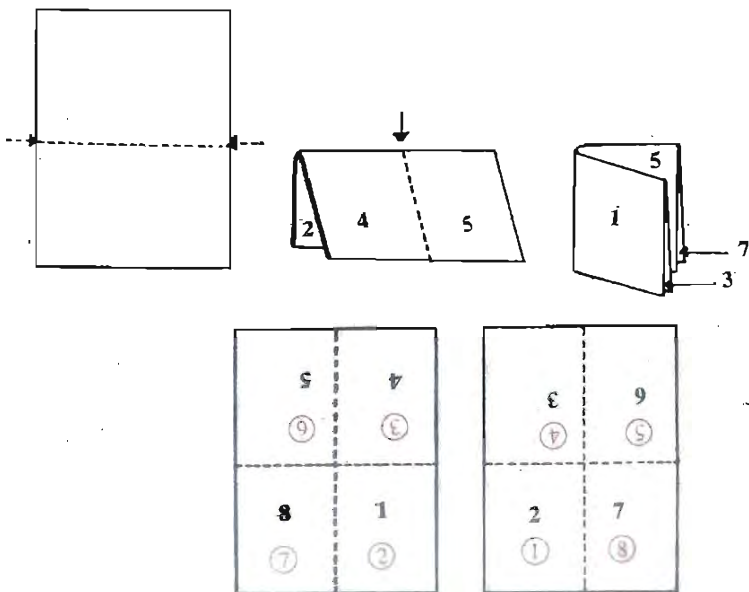
Proofs are returned with all corrections marked, along with instructions about insertion of illustrations and diagrams, style and position of headings, dimensions of pages, and a number of other matters concerned with the division or breaking up of the set matter into pages. Here again, computer-assisted typesetting comes into its own. The comparative ease with which corrections can be carried out has already been mentioned. Computer programmes are available that automate a substantial part of the page-making operation also. The computer can act on instructions and specifications encoded on the disc in electronic terms, which enable the photosetter or laser printer to turn out prints of the matter in the desired paged form. The convenience of the system will be appreciated when one considers the labour and hassles involved in handling heavy trays of metal type. Even the task of cutting and pasting lengths of photoset matter in page form manually is quite a tedious business which computer assistance eliminates entirely.

Imposition

Gutenberg printed his celebrated Bible one page at a time. Today many pages are printed simultaneously. This book, for instance, will be printed on sheets of paper 65 × 86 cm in size, 16 pages at a time on each side of the paper. The

whole of it, minus the cover, will be printed on two sheets of this size printed on both sides to make up its 64 pages. To make this possible the pages have to be arranged in a way that would ensure that when the printed sheets are folded, the pages will be in the right sequence and the right way up.

To simplify matters, let us suppose we have a small machine that can print only four pages at a time and, taking a rectangular sheet of paper, fold it in half from



Getting pages in the right sequence : (Follow the instructions in the text.)
 Uncircled figures represent the numbers of pages on the face of the sheet seen in the pictures; those circled represent the numbers of the pages behind them, on the other side of the sheet.

top to bottom across the longer edge; then left to right across the shorter edge; and then, without cutting the folds, number the pages 1 to 8 and unfold the sheet. The sheet will have pages 1, 4, 5 and 8 on one side and 2, 3, 6 and 7 on the other. From the accompanying diagram it will be clear how the pages will have to be arranged for printing four at a time back to back on a single sheet and which way up they should be in each case.

In the case of books set in metal type, the printer *imposes* and *locks up* the pages in a steel frame as a *forme* (see picture on page 42) according to this sequence. He has also to ensure that the pages in the book will have uniform margins and that the pages printed on the two sides of a sheet *back-up* correctly, that is that they are exactly back to back on the two sides of each leaf. (A *leaf* is a single sheet in a book, consisting of two pages, and is in most cases printed on both sides.)

In the case of books that have been photaset, the imposition is much less physically laborious, but equally exacting in terms of care and accuracy demanded. Diapositive prints of the negatives, that is positive prints on transparent film of each page have to be pasted in the exact position required to print down a composite plate of all the pages constituting the *forme*. In an alternative method, the negatives themselves may be pasted down to form a composite negative *forme* which is transferred directly to the offset printing plate by a slightly different process, without the intermediate step of printing positives.

We have already outlined the two major printing processes and can therefore move on to how the printed sheets are transformed into the volumes we place on our shelves.

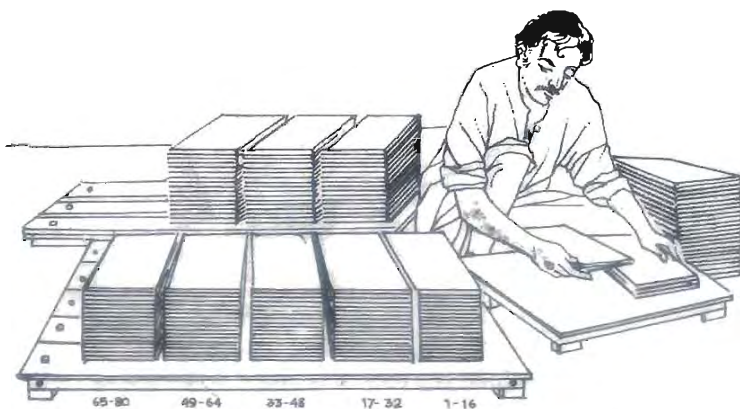


Negatives and positives like these on transparent film are so much easier to handle and lay out than the heavy metal frame, metal type and the other materials used to lock traditionally typeset matter into position for printing as shown in the illustration on page 42.

Binding

After all the formes are printed, their number depending on the length of the book, the printed sheets are passed on to a bindery where they are folded into *signatures* or *sections*. These sections are then *gathered* in sets in correct sequence and sewn together through the back folds of the sections. Batches of these folded, gathered and sewn *book-blocks* are then trimmed at the top, bottom and right edge (the left edge for Urdu) to free the pages on top and give the books a neat appearance. A cover is then fixed which may be either of paper or card, or cardboard covered either by paper or cloth.

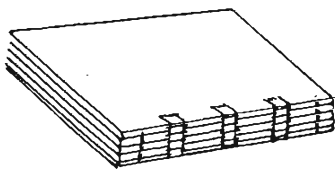
When the number of pages are not too many, as in the case of this book which has just 64 pages made up of two 32 page sections, one placed within the other and both within a paper cover, you will see that the three units may be held together by a pair of wire staples through



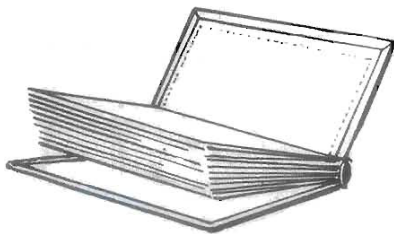
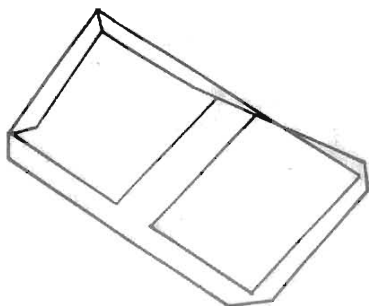
Gathering the sections in correct sequence.

the back fold. The same could of course be done with four 16-page or eight 8-page sections.

Currently seen in the case of many imported and some Indian paperback books is a binding that uses no sewing. The back of the gathered sections is trimmed to a rough surface on which a special flexible synthetic glue is applied to hold the sheets together and also to attach them to a card or paper cover. As is to be expected, this sort of binding is not very strong and, sooner or later, individual leaves or bunches of them may start working themselves loose from the rest.



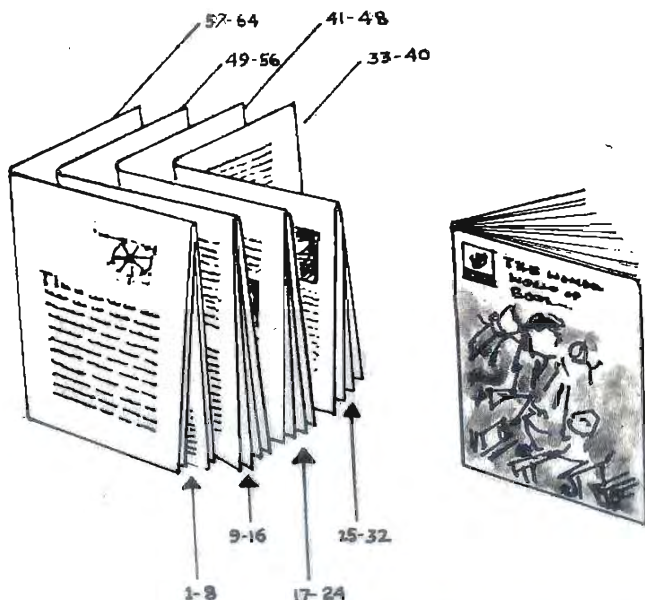
Gathered sections sewn and trimmed. Tapes are sewn in for additional strength.



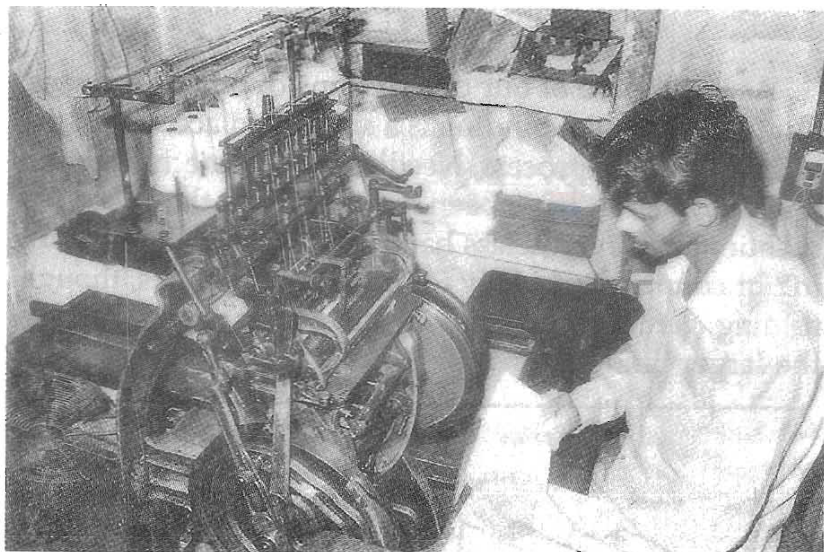
Making the cover of a book to be bound in stiff boards.

Cover glued on to the book.

As in the case of our descriptions of other processes, our description of binding is a simplified account of the essentials of the process. Needless to say, mechanization and automation have been applied to all the processes mentioned. Nevertheless hand binding is still dominant in our country, especially for hard-bound books, though folding, gathering and sewing have been mechanized in the larger binderies.



Binding a centre-stitched book like this one. The sections go one inside the other, with the cover on the outside. The pages are stapled together through the back fold.



Sewing together of the gathered *sections*, long done by hand, is done mechanically by machines like this one to make up *book blocks* like the one shown in the upper part of the illustration on page 48. Folding and gathering of sections in correct sequence have also been mechanized. Below is a photograph of a folding machine.



ILLUSTRATIONS

In the letterpress (Gutenberg) process, simple one-colour (black on white, most often) illustrations consisting of simple lines of varying thickness and solid patches here and there (see illustrations on pages 16,17 and 20–21) are reproduced from zinc or copper plates, mounted on wood to bring their surfaces up to the same height as the surfaces of the type, along with which they are used. The combination of plate and mounting is called a *block*. The illustrations are transferred to and fixed on the plate by a combination of photographic and chemical processes which result in a surface on which the portions of the illustration that have *not* to print (the white portions in black on white printing) are either removed altogether or get etched down by acid to a level lower than the printing surface.

If the illustrations to be reproduced contain varying shades (tones), as is true of most photographs, these are reproduced by splitting the image into a pattern of very small dots of sizes varying with the depth of shade/tone required. This is done by placing a fine screen of crossed lines on a glass plate in front of the lens when transferring the illustration to the zinc or copper plate. Over the darker portions, the dots on the plate remain large and close and therefore print darker than the portions where the dots are smaller and consequently have more white space between them and, in fact, all but



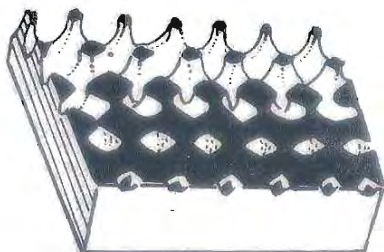
A screen, greatly enlarged.



A half-tone block.



A half-tone picture and a portion of it greatly enlarged to show the dot pattern.



What a half-tone block would look like if viewed from the edge and greatly enlarged.

disappear in the white or near-white portions. The change from dark to light, or the other way about, can be either gradual or rapid, or even sharp, as might be necessary when reproducing a photograph with bright highlights and deep shadows.

If you look closely at the reproduction of photographs in this book or in newspapers and magazines you will see the dot pattern quite clearly. A magnifying glass will show even more clearly how the varying sizes of dots makes the reproduction of tones possible.

For offset printing of illustrations, the process of transfer of the image to the offset plate is similar but, since the process is planographic, printing areas are not raised over the general surface to any appreciable extent.

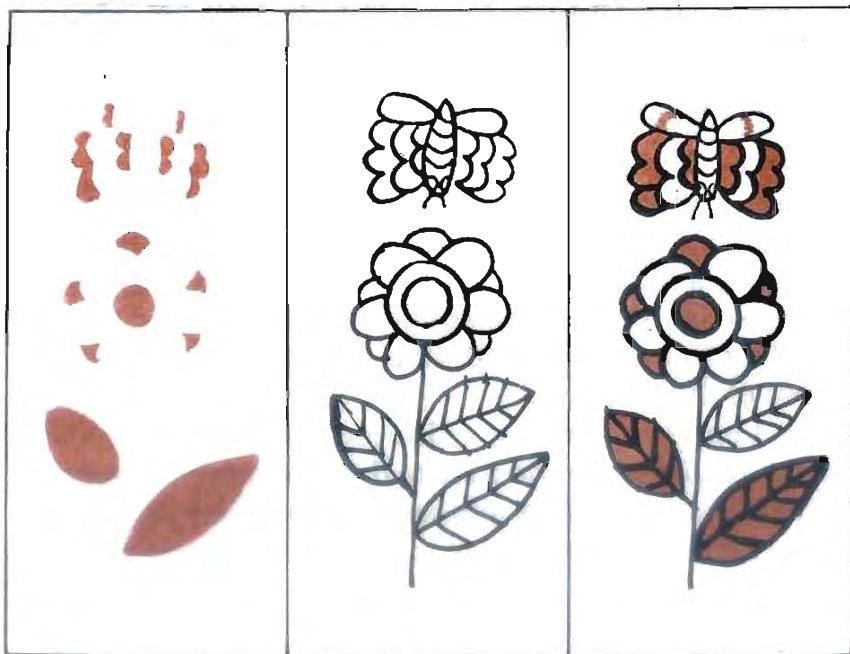
Colour

Printing in more than one colour, at its simplest, is achieved by printing each colour in succession. This is possible only if the colours are simple and distinct, as is the case of those illustrations in this book requiring printing in a colour in addition to black, leaving aside those on the cover.

When reproducing coloured photographs and paintings, however, we have to deal not only with tones, as in the case of a black and white photograph or sketch, but with tones in an infinite range of colours and shades of colours. Fortunately, all these can be broken down into combinations of four colours: yellow, magenta (a deep purplish red), cyan (a shade of blue) and black. These combine in various strengths to give the total effect. If we

have blocks or plates corresponding to each of these colours and print them on the same surface one after the other in transparent inks of these colours, we get a fair reproduction of the original colours.

To achieve the necessary *separation* of the colours, photographic 'filters' are used when taking four successive photographs of the original. At each stage, the unwanted colours are absorbed by the filter and only the required one registers on the film in proportion to its strength in the original. This gives us a series of four

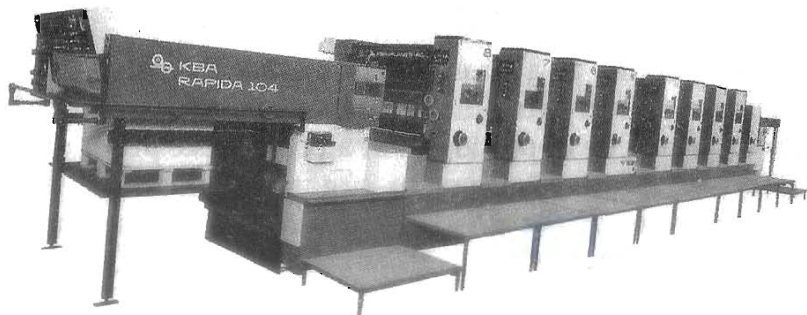


A set of two-colour line blocks. The impressions made by each of them separately and with the second colour printed over the first are shown.

negatives, each corresponding to one of the four colours. It is these that are used to prepare blocks/plates. When these are used for printing the colours they represent, one over the other in transparent inks, the result is a remarkably close imitation of the original.

In recent years, 'colour separations' are being done by 'electronic scanning', the colour and shade of each microscopic point of the original being analysed into three basic colours and black by what might be called a highly sensitive electronic eye. The process gives much more accurate results than optical separation with colour filters.

The process of four-colour printing is illustrated on the back cover. For very special purposes, for costly art prints for example, even more separations may be made and printing in seven or eight, or even more colours may be undertaken.



A multi-stage offset printing machine. See also the diagrammatic representation of the same machine on page 34.

AUTHORS, PUBLISHERS AND COPYRIGHT

Printing and paper made it possible to make a large number of copies of a book with very much less labour and in very much less time than it would take to make the same number of copies by hand. But this can only be done in printing plants which have expensive equipment and machinery and a number of people working for them. It also costs quite a lot to provide the paper and other materials required, and to get the copies bound. Even if an author has the money to get his books printed, it is hardly ever possible for him to *sell* more than a few copies himself.

This is where a *publisher* has to step in. Authors, usually in return for some payment, give publishers the right to print, publish (make public; make available to the public), and sell their writings in book form. Publishers undertake this activity in the expectation that they will be able to sell the books at a profit. A publisher is therefore a business-person who puts his money into the printing of books which he hopes to sell at a profit. Like producers of other goods, he has to organize not only the manufacture of the goods he deals in, but also their distribution and sale.

Copyright

We have just spoken of the author 'giving the publisher the right' to publish his book. This implies that only the



The international copyright symbol. This, along with the name of the owner of the copyright and the year of writing or publication, printed in the book, gives it copyright protection in all countries that have joined the International Copyright Convention. (See the copyright statement on the back—*verso*—of the title page of this book.)

author has the right to use his creation and profit from its use in any way. The right to make copies of his work and make them available to others for reading is, among other related rights, one of the major rights an author possesses. This package of rights of an author in relation to his work is protected by law in our country, and in almost all other countries. It is called *copyright* and is, in most cases, enjoyed by an author in our country for his whole lifetime and by his heirs for 60 calendar years after his death for all works still in copyright at the end of 1991, and all fresh copyrights arising after that.

Till recently, as in many other countries, this period was 50 years and was extended to 60 in India only in 1992. Copyrights that had already lapsed before that, under the 50 year rule, are not entitled to an extension under the new provision even if their late owners (the authors) died less than 60 years ago.

After its 'legal term of copyright' is completed, anyone can make copies or otherwise make use of a work (publish a translation or make a film based on it, for example), without anyone's permission. Thus the works of Rabindranath Tagore, whose works would have gone out of copyright at the end of 1992 under the 50-year rule, since he died in 1941, will now go out of copyright (go

into the 'public domain' as it is termed) only at the end of 2002. Copyright in the works of Bal Gangadhar Tilak who died in 1920 lapsed at the end of 1970, while that in the works of Jawaharlal Nehru who died in 1964 will lapse only at the end of 2024.

Authors did not always enjoy copyright protection. In fact, before printing and publishing developed no great need was felt for it. It was only when it became comparatively easy to copy works in large numbers and sell them at a profit that copyright protection for authors became necessary.

Copyright protects the publisher as much as it does the author as it ensures that, once he has been given the sole right to publish a book, no one else can do so.

Most countries have agreed to respect the copyright of one another's authors, but some countries have yet to do so. Almost all of them, however, have laws protecting the copyright of their own authors internally.

Booksellers' Discounts

To interest booksellers in selling what has been published, publishers sell copies of their publications to booksellers at what is called a *trade discount*, that is at some percentage lower than the prices fixed for their sale to the public. Thus, if a publisher allows booksellers a discount of 25 per cent, he will sell a book he has priced Rs 40 to a bookseller for Rs 30. When the bookseller sells the book for Rs 40, he will have Rs 10 to cover his expenses and get some profit.

Author's Royalties

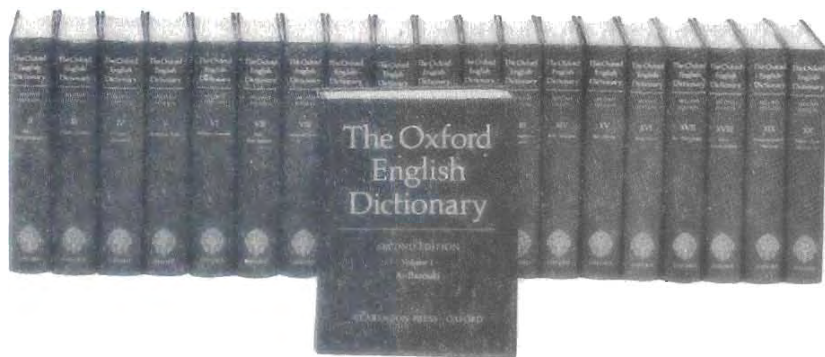
What about the author? How does *he* get his reward?

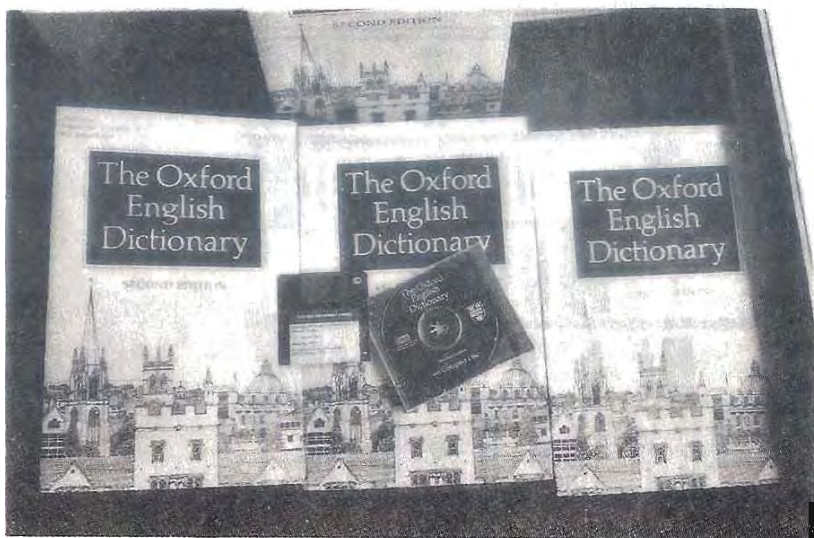
The commonest form in which a publisher pays an author for permission to print and sell his work is *royalties*. A *royalty* is a payment made for the use of someone else's idea or creation or invention. In the case of books it is usually calculated as a percentage of the total price of all copies sold. Thus the more copies of an author's book that are sold, the more he gets paid as royalties. For example, a 10 per cent royalty on a book priced Rs 40 would be Rs 4, that is the publisher would have to pay the author four rupees for each copy of the book sold.

It is of course possible, if this is agreed between author and publisher, to follow other methods of paying the author. For example, a fixed amount may be paid, irrespective of the number of copies printed or sold; a fixed payment may be made for an agreed number of copies printed, irrespective of sales; or, rarely, a publisher may pay nothing to an author till he has recovered his expenditure on the production of the book and then share the profits with the author.

THE FUTURE OF THE BOOK AND THE BOOK OF THE FUTURE

With every technical advance in the electronic media, doubts have been expressed concerning the future of the book. First, it was the radio that was expected to draw people away from books; it did the opposite. Then it was TV and video; the outcome was not much different. There were even some electronic-media fanatics who argued that with TV and video available as media of direct instruction, information, demonstration and entertainment, literacy was no longer essential for ordinary, everyday life and work for large masses of our people! While we all agree that the electronic media are effective instruments of education at all levels, few of us could agree that any individual could really do without books. The future of the book as a major source of information thus seems secure.





The Oxford English Dictionary (2nd edition) comprises 20 large (30.5 × 22.5 cm) volumes with a total of 21, 728 pages. The whole of its content is stored in *machine* (computer) *readable* form in a single *compact disc* as shown. The smaller disc is used for retrieval of information under a variety of classification heads (in addition to the usual alphabetical sequencing) without having 'manually' to search through pages after pages of entries. This electronic version of the dictionary sells at about a third of the price of the 20-volume print on paper edition.

But the aspect of the book that is now being challenged is not its relevance but its *form*. Already personal and institutional computers are being used to gain access, through telephone links, to large national and even international 'data-banks'. These are vast amounts of information relevant to various subjects stored on super-computers. This information would previously have been (and still is) sought in large reference works



This sketch is broadly indicative of the size of a 'handheld digital book' that could store the equivalent of the Bible ten times over — more than 3,000 pages of closely printed text.

like dictionaries, encyclopaedias, handbooks and directories. Now in many countries this kind of information is available to subscribers who can read it on their computer display units and even print it out for themselves if they wish to.

But snippets of information on a screen do not constitute a book. Actually there is nothing to prevent a whole book being presented page-by-page on a computer screen and its being printed out by a printer associated with it. But one of the essential characteristics of a book would be missing — usability without the need for any equipment, not to mention benefits like portability, ease of handling, legibility and elegance.

What has come near to giving books a new form is what communication professionals call the Handheld Electronic Book (HEB). Thanks again to the increasing miniaturization of computer circuitry, whole multimedia encyclopedias, the Bible and all of Shakespeare's works are available in HEBs of normal book size with rechargeable, self-contained power sources. On the screen one can perform the equivalent of turning pages and browsing, and locating items in an alphabetical sequence. Recent developments are towards a reading (screen) device with interchangeable discs so that libraries would exchange your discs rather than your books.

Problems remain—like legibility, readability, reproduction of illustrations (especially coloured ones), costs, prices and so on, but it is unwise to expect that they will not be solved quite soon. The developments

which have already taken place within the last ten years are enough to drive this lesson home.

How soon and whether the HEB will replace the present-day book, in what direction it will develop and the new forms it might take are beyond anyone's ability to predict. But most of us would hope that the book as we know it now will continue to be made, for aesthetic if for no other reasons. Perhaps, some time, even the HEB may be able to match and display the sheer beauty of an elegantly designed page of printed text. But will it ever be able to match the pleasure of smelling and handling a page of printed paper, turning it over and then turning it back again?



This sketch indicates approximately how small a handheld electronic book could be. Besides being a reading device it stores the content of 4-6 medium length books and a power source (rechargeable cells). The device of which the size is indicated in the illustration on p. 62 is described as 'digital' as against the device shown above and described as 'electronic' — which, presumably, accounts for their different storage capacities.

THE FOUR-COLOUR PROCESS



Yellow



Magenta



Cyan



Black



Yellow & Magenta



Yellow, Magenta
& Cyan



Yellow, Magenta,
Cyan & Black

ISBN 81-237-2470-5



National Book Trust, India